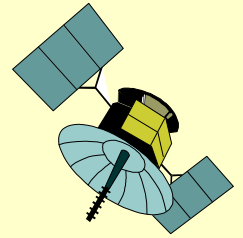


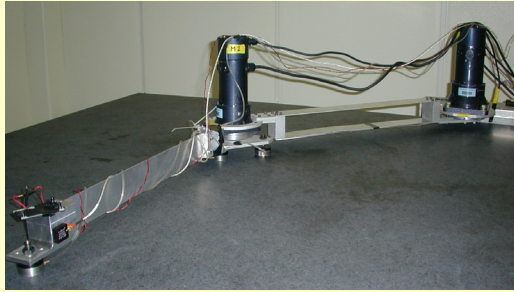


Spacecraft Research & Design Center

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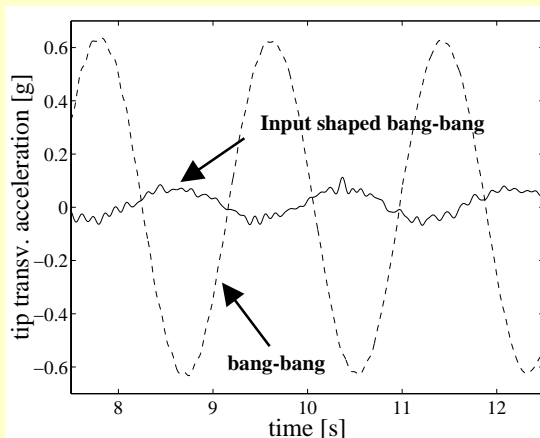


Space Robot Simulator



Objective: To minimize the vibration and the settling time for flexible space manipulators.

- The simulator consists of a two-link manipulator, whose links can be rigid or flexible.
- It floats on a granite table by four air pads to simulate a micro-gravity environment.
- The design is modular so that both links can be configured either rigid or flexible.
- A dSPACE PPC control system, hosted on a Pentium III/500 MHz PC, is used to develop the control laws.



Various torque profiles, such as bang-bang, smoothed bang-bang, and input shaped bang-bang profiles, were experimentally evaluated to reduce the vibration and the settling time of slew maneuvers. For the flexible-rigid configuration of the manipulator, as shown in the top figure, the residual vibration of the manipulator due to bang-bang torque profile is reduced by 87 % when the same profile is input shaped.

Theses

1. M. Romano, *Experiments on Near-Minimum-Time Control of Flexible Space Robot Using Command Shaping Techniques and Joint Friction Compensation*, Ph.D. Dissertation, Politecnico di Milano, Feb. 2001
2. G. E. Yale, *Cooperative Control of Multiple Space Manipulators*, Ph.D. Dissertation, NPS, Sep. 1993
3. G. Janvier, IV, *Adaptive Control for a Spacecraft Robotic Manipulator*, Master thesis, NPS, Dec. 1993.

Publications

1. F. Bernelli-Zazzera, M. Romano, and B. N. Agrawal, "Experiments on Tracking Control of a Flexible Space Manipulators," *The 51st Congress of the International Astronautical Federation*, Oct. 2000, Rio Janeiro, Brazil.
2. G. E. Yale and B. B. Agrawal, "Lyapunov Controller for Cooperative Space Manipulators," *Journal of Guidance, Control, and Dynamics*, 21(3):477-484, May-June 1998.
3. G. Janvier IV and B. Agrawal, "Adaptive Control for a Space Robotic Manipulator," *The 45th Congress of the International Astronautical Federation*, October 9-14, 1994, Jerusalem, Israel.

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